(12) UK Patent Application (19) GB (11) 2 327 823 (13) A

(43) Date of A Publication 03.02.1999

(21) Application No 9715975.0

(22) Date of Filing 30.07.1997

(71) Applicant(s)
Nigel Geoffrey Ley
36 Welbourne, Werrington, PETERBOROUGH, Cambridgeshire, PE4 6NH, United Kingdom

(72) Inventor(s)
Nigel Geoffrey Ley

(74) Agent and/or Address for Service
Nigel Geoffrey Ley
36 Welbourne, Werrington, PETERBOROUGH, Cambridgeshire, PE4 6NH, United Kingdom

(51) INT CL^6
H04N 7/18 , B60R 1/00

(52) UK CL (Edition Q)
H4F FAAE FD12M FD12X FD18K FD2A FD27R1 FD27R9 FD30K FD31M

(56) Documents Cited
GB 2287152 A GB 2283149 A WO 96/38319 A2
US 5448319 A US 4937665 A

(58) Field of Search
UK CL (Edition P) H4F FAAE
INT CL^6 B60R 1/00 11/04 , G08B 13/196 15/00 , H04N 7/18
Online databases: WPI, EPODOC

(54) Abstract Title
Rear-view viewing system

(57) A viewing system for use in vehicles to provide the driver with a rear view image, comprises one or more video camera modules adapted to be co-operable with a mirror inclined at a suitable angle over the camera lens, video signal transmitting means, either hard-wired or wireless, for transmission of the image to a remote electronic display screen mounted in front of the driver, said screen being either a cathode-ray television or a flat-panel electronic display similarly adapted to be co-operable with an image re-directing mirror.

The display means is mounted in the least space consuming orientation and the image re-directing mirrors enable a wide variety of display monitors to be adapted for best use in different types of vehicle.

Additional function modules may be incorporated to provide remote vehicle security monitoring accessed through a suitable telephone network.

GB 2 327 823 A

Viewing System

This invention relates to a vehicle rearward viewing system.

Rear-view mirrors for vehicles are well known image reflectors which comprise a pivoted mirror and holder mounted on a suitable anchorage point in front of the vehicle's driver position, the mounting being either internal or external to the vehicle according to whether the desired and feasible field of view to be covered is the immediate rearward space from the centre outward on a wide angle basis, or along the left or righthand sides of the vehicle. Thus internal mirrors are normally mounted overhead centrally relative to the width of the vehicle so as to focus through the rear window, while external wing mirrors are mounted on the left or righthand sides of the vehicle. By means of the pivot the angle of inclination of such mirrors is adjustable to obtain the optimum view.

Facing rearward of the driver, such mirror systems afford the driver a mirror-image view of the space to the rear of the vehicle, the image being converted by the mirror to a correct and natural right-way-round view so that objects to the rear left, centre and right are seen to the left, centre and right respectively. This is an important advantage of the mirror.

A problem with such mirror systems, however, is the need for the mirror to be unobstructed by any solid or opaque barrier within the mirror's field of view. The length and type of the vehicle also influences the size and placement of the mirror. Many vehicles have no rear window for the driver to see through. Lorries, box vans, and towing vehicles, for example, all have barriers or a load interposed between the space to the immediate rear of the vehicle and the driver, and thus have to rely on wing mirrors, often mounted on extended mounting arms. The drivers of such vehicles are prevented from seeing immediately to the rear of the vehicle and this can cause difficulties when reversing.

Most vehicles have a dashboard constructed immediately behind the windscreen. The dashboard provides a ledge giving limited shelf space and the means for incorporating a range of visual and control instrumentation of compact size.

An object of the present invention is to provide a modular viewing system, essentially comprising a rear-mounted video camera, or cameras, and a forward-mounted electronic display screen, that is adaptable to any type of vehicle and provides a clear rearward view, irrespective of the type of vehicle, and thus provides an improvement in the ease and safety with which a vehicle may be driven, including driving in reverse.

A second object is to provide a system that is flexible to further adaptation for the provision of additional facilities,

such as the remote security monitoring of a vehicle, and the recording of road events during the vehicle's journeys, for evidential purposes.

A still further object of the invention is to utilise, where appropriate, mirrors in conjunction with electronic image capture, transmission and display means such that a mirror-image of a rear-view scene captured in a first mirror mounted aft of the vehicle driver may be clearly displayed in a second mirror mounted to the front of the driver, with suitable magnification as may be desirable. The purpose of this object is to enable image scanning and image display device modules of compact size to be mounted in the most space-saving orientation, for example vertically rather than horizontally, the mirror re-directing the image through an optimum angle of inclination. In this way many different types and sizes of video camera and display screen, whose longitudinal dimension may be less well suited to horizontal mounting on a dashboard or rear parcel shelf, may be utilised to suit different requirements such as lens and screen size as is most appropriate to a particular vehicle. Thus, for example, a cathode ray tube television monitor may be vertically mounted with its screen in an essentially horizontal plane without causing an undue obstruction of the windscreen.

According to the present invention, therefore, there is provided a modular rearward viewing system, with universally variable fields of view, comprising one or more video cameras, an electronic visual display screen, means for interconnecting and controlling the camera(s) and display screen, the camera(s) and display screen being adapted respectively to be each co-operable in close conjunction with an adjustably pivoted, demountable mirror, said mirrors being angled above the camera lens and display screen respectively by a pivot or hinge means, the camera(s), display screen and mirror unit(s) having adjustable angles of inclination relative to one another and being so arranged within their appropriate housings, as to transmit electronically, from the rear-most camera or mirror, a rear-view image to the display screen, said screen being mounted in the least space consuming orientation to a suitable and adjustable anchorage point in front of the vehicle's driver position. The display screen is preferably a flat-panel display of a width, depth and height comparable to that of a conventional internally mounted rear-view mirror, but may also be a cathode-ray tube television of compact size.

The cameras and respective mirror units are preferably housed in a protective enclosure in which they may be preset to an optimum inclination or in which they may be adjusted by means of adjustment screws after the housing has been mounted, the housing having a suitable observation window through which the camera unit may focussed. The housing may have a hinged lid which can be opened and supported at a suitable inclination by means of springs or support arms. Scissor or trellis arms would

be suitable. The said units may then be mounted at any appropriate and advantageous position on the vehicle. This may be externally of the vehicle, such as a central position on the roof end or the rear bumper of a lorry, or internally in proximity to the rear window of a bus, coach or a towed caravan, for example. For externally mounted camera modules the housing is preferably a weather proof sealed unit. To permit a camera panning facility the housing may incorporate a motor driven turntable or similar means. Alternatively, the camera module may be incorporated within the vehicle's rear light lens assembly suitably adapted to accept the camera.

In terms of component modules all the technical requirements for providing the desired essential features of the present invention are readily commercially available as modules and may be assembled or interconnected, by persons skilled in the art, in various combinations and configuarations to suit particular preferences, adaptations, additional features, modes of signal generation, modulation, transmission, reception and methods of control as may be appropriate to a particular type of vehicle. For example, small video cameras are available in the form of what are known as board cameras, with good sensitivity to dark or low light levels, while electronic display screen means are available as cathode-ray television monitors, liquid crystal display screens and many other types of flat electronic display screens. A small, flat cathode-ray television monitor with a four inch screen is known to be available and is used extensively in door entry systems.

Currently, the required flat-panel display screens available are not of the preferred size. However, the smaller of such screens may still be utilised by combining them with a mirror giving a suitable scale of image magnification. This may be in conjunction with a lens, diffraction grating or similar means for expanding the image size. Alternatively, more than one such flat-panel display screen may be combined side-by-side and means for dividing the camera image provided so that each display shows a portion of the camera image. In this way the the driver's display screen may be kept as small as possible and be mounted in the normal overhead position rather than on the dashboard.

Alternatively, an image display receptacle as described in GB patent application No. 9612917.6 may be specifically adapted for use with the present invention.

Preferably, camera switching means, including multiplex, memory and microprocessor control and selecting means, are provided for sequentially switching the display from one camera view to another, for combining the views of more than one camera on the display screen simultaneously and for retaining recorded images evidential purposes.

for

For some vehicles the transmission means is preferably wireless, that is to say the video images are broadcast in television image quality from the camera to the display screen by a television transmitter module and received at the display screen via an ariel and radio frequency receiver module, with signal converter as appropriate. The picture signal may also be transmitted by the irradiation of modulated infra-red light beams. Such embodiments may thus cater for all types of vehicle, but may not always be economically justifiable in a vehicle which has a body rigidly fixed to the driver's compartment. Alternatively, therefore, the video signal may be transmitted through a wire, such as a coaxial video cable, connected between the camera means and video image display means, or may be transmitted as digital patterns of pulsed light signals along a fibre-optic cable connected between suitable transmitter and receiver modules. Preferably, provision is made for a combination of wireless and wired transmission and reception means to be employed, especially with respect to opto-electronic image transmissions, thereby enabling cable runs to be confined to areas where they do not cause inconvenience. Alternatively, such modules may be incorporated essentially into two integrated circuit modules with suitable interfacing means to permit the attachment and connection of the transmission and reception module means most suitable to a particular vehicle.

In some embodiments the transmitted signal may be a composite video signal, or analogue; in others it may be a digitised signal, the particular signal mode being compatibly matched to the respective camera, screen display means and mode of transmission and reception. Optionally, the image displayed may be monochrome or in colour, and infra-red emitting means may be provided to enhance the camera's operation in times of darkness.

The orientation of the camera means relative to the mirror means may be manually adjustable or electro-mechanically adjustable, according to whether the viewing system is to provide a purely rear-view viewing facility or the optional addition of vehicle security monitoring facilities with a variable field of view. In the latter embodiment the mirror means is preferably arranged to be rotative to scan through 360 degrees under motor driven power, thereby providing a variable field of view. This may be bi-directional and driven by a stepper motor. The basic orientation of the camera means is envisaged to be near vertical and focussed on the central image area of the mirror inclined over the lens, but bi-directionally adjustable backward and forwards through a sufficient degree of arc as to be able to occupy horizontal orientations as well, to provide a tilt facility, including a direct view unaided by the mirror means through the window in the protective housing. Thus the camera may face rearward in an essentially horizontal orientation, or any suitable angle of inclination, face near vertically in its normal orientation, or forward in a further

horizontal orientation or at any angle of inclination in between said orientations. When the video image originates solely from the video camera the camera must be capable of having its horizontal scan reversed so as to produce a true mirror image on the display screen. A line-lock facility is also preferably provided. The advantage of focussing a video camera on a rearward facing angled mirror above the camera lens is that a miniature camera can thus produce a larger image of higher quality definition on the display means and be mounted in the least space consuming orientation. Cameras lacking a reversibly switchable mirror-image facilty may also be deployed without need of modification. The mirror may also be masked to produce a shaped image area conforming with the shape of the electronic display screen means.

A specific embodiment of the present invention in its most basic form will now be described by way of example together with some optional alternatives.

The modular rearward viewing system comprises, within a protective housing, which may have a hinged lid, a video camera module with video signal transmitting means, whereby, when the lid is opened and supported in a vertical or near vertical plane by adjustable legs, or when the camera is focussed on the appropriately inclined, rearward facing, angled mirror above the camera lens, the video signal transmitting means transmits the video image from the camera to an electronic display screen means mounted on a suitable anchorage point in front of the vehicle driver's line of view, the display screen means being similarly adapted, depending on its bulk, to be co-operable with an image re-directing mirror, thereby providing a natural, high definition, full-size mirror-image of the space to the rear of the vehicle. More than one camera system may be deployed at suitable locations on one vehicle and switching means be provided for selectively displaying different camera views sequentially or in combination . The camera and the mirror modules are pivotally mounted and thus adjustable relative to one another and thereby able to provide variable fields of view through panning and tilting. The camera module mirror may optionally be imbedded in the hinged lid of the housing. When the hinged lid is closed the inclined mirror is folded down on its own hinges to lay flat above the camera means.

The transmitting means may be hard-wired to the driver's display screen or it may be wireless by provision of radio transmitter means.

Motor drive means may be provided for electro-mechanical rotative adjustment of the mirror radially about the normally near upward facing camera, thereby permitting the mirror to pan through a 360 degree field of view. The camera lens or lenses may be of fixed or variable focal length. A preferred variable focus lens may be motor driven for focus control.

Alternatively, a flexible, transparent membrane, variable focus lens, containing water or silicon oil, may be adjusted for focus and magnification by increasing or decreasing the pressure of fluid between the membrane layers by a motor driven pump.

Control circuitry powered by the vehicles electricity supply may be housed in the camera housing, the display screen module or may be provided in a separate housing.

In an extended embodiment of the basic present invention, security surveillance of the vehicle is provided by remote radio control means of the camera and mirror means, preferably by cellular radio telephony means and optionally in conjunction with an alarm and appropriate sensors. A driver may thus telephone his vehicle and obtain real time images of the security of his vehicle, or he may be automatically alerted through the alarm sensor activating an auotomatic dial-up facility. Optionally, a partially silvered mirror, mounted forward of the driver, may be incorporated with a miniature video camera behind, so as to provide means of covertly monitoring the identity of the driver. The driver's image may be transmitted through a celluar radio telephone link or similar means to a central control station for driver verification before remote control means governing the running of the engine, permit the engine to be started.

It will be appreciated that many alternative embodiments may be fashioned from the basic form and that such modifications, including digital microprocessor data processing and presentation of many types of information useful to the driver, may be provided by adding modular acccessories to a basic modular system.

CLAIMS

What I claim is:-

1. A modular rearward viewing system comprising one or more video cameras with variable fields of view, an electronic visual display screen, interface means for interconnecting, switching and controlling the camera(s) and display screen, the camera(s) and display screen being adapted respectively to be each co-operable in close conjunction with an adjustable pivoted mirror, said mirrors being angled above the camera lens and display screen respectively by a pivot or hinge means, the camera(s), display screen and mirror unit(s) having adjustable angles of inclination relative to one another and being so arranged within their appropriate housings, as to transmit electronically, from the rearward facing camera or mirror, a rear-view image to the display screen, said screen being mounted in the least space consuming orientation to a suitable and adjustable anchorage point in front of the vehicle's driver position.

2. A modular rearward viewing system as in Claim 1 wherein the electronic display screen is a flat-panel display of a width, depth and height comparable to that of a conventional internally mounted rear-view mirror.

3. A modular rearward viewing system as in Claim 1 or Claim 2 wherein the electronic display means is a compact cathode ray tube television.

4. A modular rearward viewing system as in Claim 2 or Claim 3 wherein the screen of the flat-panel display or cathode ray tube is in a horizontal orientation and the picture is re-directed to the driver by a demountable mirror having an adjustable angle of inclination relative to the screen.

5. A modular rearward viewing system as in Claim 4 wherein the mirrors are masked to produce a shaped image area conforming with the shape of the electronic display screen means.

6. A modular rearward viewing system as in Claim 5 wherein the mirror means provides magnification of the image displayed or captured.

7. A modular rearward viewing system as in Claim 6 wherein the magnification means includes a magnifying lens, diffraction grating or similar magnification means.

8. A modular rearward viewing system as in any preceding claim wherein the video image transmitting means is hard-wired or wireless connected to the video receiving and display means, or is a combination of both said means.

9. A modular rearward viewing system as in Claim 8 wherein the video image transmission means is by modulated infra-red light signals from a transmitter to a receiver.

10. A modular rearward viewing system as in Claim 9 wherein the modulated light signals are transmitted through a fibre-optic cable.

11. A modular rearward viewing system as in any preceding claim wherein the video camera unit(s) are provided with electro-mechanically controlled universal panning and tilting means.

12. A modular rearward viewing system as in Claim 11 wherein the camera units are provided with infra-red light emitting means in order to provide additional illumination during times of darkness.

8. A modular rearward viewing system as in any preceding claim wherein camera switching means, including multiplex, memory and microprocessor control and selecting means, are provided for sequentially switching the display from one camera view to another and for combining the views of more than one camera on the display screen simultaneously.

9. A modular rearward viewing system as in any preceding claim wherein the interface means includes interface means for incorporating facility extending communication and alarm modules for providing remote security surveillance of the vehicle via a public telephone network.

11. A modular rearward viewing system as in Claim 9 wherein the surveillance means incorporates digital memory means and a partially silvered one-way mirror concealing a driver observation mirror in order for recorded images of a driver to be communicated to a central control station for driver verification.

12. A modular rearward viewing system as in Claim 11 wherein the communication module provides full duplex communication and is adapted to co-operate with remote sources of information useful to the driver.

13. A modular rearward viewing system as in any preceding claim wherein the transmitted video signal is a composite video signal, analogue or digitised signal, the particular signal mode being compatibly matched to the respective camera, screen display means and mode of transmission and reception.

12. A modular rearward viewing system as in any preceding claim wherein the camera units and display means provide an image in monochrome or in colour.

13. A modular rearward viewing system as in Claim 12 wherein either or both the camera(s) and display modules include a reversibly switchable mirror-image facility.

14. A modular rearward viewing system as in any preceding claim wherein the camera lens or lenses are of variable focal length and telephoto focussing is provided by a stepper motor.

15. A modular rearward viewing system as in Claim 14 wherein the variable focus lens is a flexible, transparent membrane, variable focus lens, containing water or silicon oil, and adjusted for focus and magnification by a motor driven pump for increasing or decreasing the pressure of fluid between the membrane layers.

16. A modular rearward viewing system substantially as described herein.

The Patent Office

Application No: GB 9715975.0
Claims searched: 1

Examiner: Sue Willcox
Date of search: 13 November 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4F (FAAE)

Int Cl (Ed.6): B60R (1/00, 11/04); H04N 7/18; G08B (13/196, 15/00)

Other: Online databases: EPODOC, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2287152 A	(Toad Innovations) - see whole document	(11)
Y	GB 2283149 A	(Mercedes-Benz) - see abstract	11
Y	WO 96/38319 A2	(Donnelly Corporation) - see particularly Figures 15 & 16	1 - 4, 8, 11 at least
Y	US 5448319	(Olympus) - see particularly col.1, line 62 - col. 2, line 19;	1 - 4, 6, 8, 11 at least
Y	US 4937665	(Autovision Associates) - see particularLy figure 1 and column 5, lines 2 - 6	1 - 4, 6, 8, 11 at least

10

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.